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ABSTRACT

This practicum addressed the importance of the development of problem solving skills in primary age children. Students need to practice recognizing the problem, deciding what steps are necessary in solving the problem, evaluating the solution, and revising the steps, when necessary. Summer camp computer students who were entering second grade practiced these skills in the EZ Logo environment while duplicating specific shapes and creating original shapes. It was determined that the Logo environment was an asset to the practice of problem solving skills. The document includes the purpose of the project, a brief literature review, a summary of the methods used, results, and recommendations. Appended are the pre/post-tests, teacher survey, results of activities, and samples of student graphics. (CW)

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DEVELOPING PROBLEM SOLVING SKILLS OF PRIMARY AGE CHILDREN WITHIN A LOGO ENVIRONMENT

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by

Patricia B. Martin

A Practicum Report
submitted to the Faculty of the Center for the Advancement of Education of Nova University in partial fulfillment of the requirements for the degree of Master of Science

October/1990

SE051767

Authorship Statement

I hereby testify that this paper and the work it reports are entirely my own. Where it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I give this testimony freely, out of respect for the scholarship of other workers in the field and in the hope that my work, presented here, will earn similar respect.

Signed Patricia B. Martin

Abstract

Developing Problem Solving Skills of Primary Age Children Within a Logo Environment.
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The importance of the development of problem solving skills in primary age children was addressed by this practicum. Students need to practice recognizing the problem, deciding what steps are necessary in solving the problem, evaluating the solution, and revising the steps, when necessary. Summer camp computer students who were entering second grade practiced these skills in the EZ Logo environment while duplicating specific shapes and creating original shapes. The objectives of the practicum were to increase the student's awareness of directionality, to develop the students' abilities to formulate plans, and to develop the students' abilities to write the directions necessary for the implementation of the plan. The time was too short, and the study group was too small for any significant findings. Nevertheless, the author's objectives for the practicum were met. This led the author to determine the Logo environment to be an asset to the practice of problem solving skills. In presentations to teachers at district level meetings and at a state computer conference, the author will recommend that teachers take time for student discussions of strategies in order to help students develop: the ability to transfer skills to other subject areas, the idea that there is more than one solution, and the idea that there is more than one way to reach a solution. Appendices include the pre/posttests, teacher survey, results of activities, and samples of students' graphics.

Appendix J

Nova University
Center For The Advancement of Education
3301 College Avenue
Fort Lauderdale, FL 33314

Observer Verification Form

Verification of Practicum Activity

Dear Observer:

Practicum students in Nova's M.S. and Ed.S. programs are asked to provide external verification that the project activities reported in their final practicum documents took place as described. You have been designated an observer to fulfill this confirmation function by the student named below. On this sheet, then, please write a note attesting to your knowledge of the project activity described in the final practicum report to which this will be attached. (Note that you are not asked to evaluate or make judgments about the quality of the project.)

Practicum Title DEVELOPING PROBLEM SOLVING SKILLS OF PRIMARY AGE CHILDREN WITHIN A LOGO ENVIRONMENT

Student's Name Patricia Martin

Program Site University School of Nova Date July 1990

Observer's Name Steven L. Bartalsky Steven L. Bartalsky
(please print---------and sign)

Observer's position Computer Coordinator Phone # 475-7313

Observer's comment on impact of the project (handwritten):

Patricia Martin used E-Z LOAD to complete her project. She worked with children 7-8 years of age and did a superb job. She was an inspiration to the children. It was my pleasure to work with Patricia, and to observe her working with the young children on her project using the Apple Computers.

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CHAPTER I

Purpose

Background

The setting for this practicum was a summer day camp housed in a South Florida elementary school that was affiliated with a private university. Each of the three summer camp sessions lasted three weeks. Campers were permitted to register for one, two, or three sessions. Each session had a morning and an afternoon program that were divided into two age groups: one for students entering Grades 2 and 3, and the other for students entering Grades 4 and up. Core camps offered to both age groups were designated with a I or II after the title to denote the younger or older students respectively. In addition to the two programs, students attended regularly scheduled activities such as field trips, canoeing, swimming and environmental studies.

The summer camp program attracted students from across the county. Forty-five campers attended half day and 220 campers attended full time. The student to teacher ratio was approximately 15:1. After school

care was provided for an extra fee. Information to aid carpooling was made available to parents. Bus service was provided at an additional expense. The cost of camp included hot lunches, afternoon snacks, field trips, and all materials.

There were three computer labs available to computer camp participants; two were Tandy labs, and the third was an Apple lab. One Tandy lab contained seven Tandy 1000's. Each computer had a color monitor, a headset, and a mouse. This lab also had a Tandy dot matrix printer, eight desks, and a table. The second Tandy lab contained eight Tandy 1000's. Each of these was equipped with a color monitor, headset, and mouse. This room also contained four tables. The third lab was equipped with seven Apple IIe's, one Apple II+, seven green screen monitors, one color monitor, and one Imagewriter II printer.

This author had taught in the public schools for 21 years: 5 years in first grade, 10 years in fourth grade, and 6 years teaching computer literacy to students in kindergarten through fifth grade. During the second three-week summer camp session, this author was one of four graduate interns who aided the

counselor and the computer campers in writing and printing a camp newspaper (Appendix A:56). Other duties of this author included assisting campers in printing samples of text and graphics produced by direct programming or the use of application software, assisting campers in running software, and assisting campers in programming. The author kept a log (Appendix B:65) of activities and personal daily duties performed at summer camp. Fifteen campers attended computer camp in the morning, and thirteen attended in the afternoon. This author helped design and make the costumes worn by the Computer I campers in the camp dress up contest. This author wrote the rap (Appendix C:73) performed by the afternoon computer campers in the camp rap contest.

Problem Statement

Frequently, students entering first and second grade display directionality problems (Clithero, 1987). This causes confusion when directions are given for fine motor paper and pencil activities as well as for gross motor spacial movement activities. Some students in this age group do not know their right hand from their left hand. This is evidenced by the number of

students who hesitate and look around when asked to raise a specific hand. When pledging allegiance to the flag, many students are confused about which hand goes over the heart.

The concepts of left and right become very important in the processes of learning to read and write. This author is in agreement with Clithero's (1987) belief that mastering the concepts of right, left, up, and down are prerequisites for developing efficient reading skills. Repetition can establish the habit of tracking left to right. Spache (1963) stated that students who frequently lose their place and have excessive regressions or repetitions need directionality training and can establish the habit of moving the eyes from left to right using a Controlled Reader. According to Spache, ". . . Visual perceptions of size, shape, likenesses and differences, line direction and continuity . . . are fundamental to the visual discrimination needed in reading, arithmetic and writing" (p. 158). Spache (1963) further claimed that directionality training should include visualization of objects, distances, and directions. Having students describe their route to school or describe the

directions necessary to complete an errand could aid in visual projection.

Handwriting is a bit more effected by left-right confusion because the directions for writing each letter may be given orally as the letter is demonstrated or practiced in a large group situation (Zaner-Bloser, 1988). Unless the teacher carefully observes each student's attempts at writing a letter, wrong directional habits may be practiced and become a problem in manuscript, cursive, and the transition between the two. Gross motor activities have been used to develop directional skills used in writing.

Students need to be able to follow directions, but students also need to learn to give directions. To do this, students must visualize what is needed or where they are to go. Then this information is organized into a sequence of steps, that when executed, will give the desired results. During the process, the student should be checking the validity of each step and changing anything that will not produce the desired result. This author is in accord with Spache (1963) in the belief that a student should learn to follow, verbalize, and write directions step-by-step. The

answers that four first grade teachers gave to a survey (Appendix D:75) that was written and administered by this author indicate the teachers' agreement with this statement. All teachers responded positively to the first five questions. The first two questions were concerned with the importance of learning directionality. Question three was written to determine if the teachers thought being able to reproduce a figure from a picture was important. The fourth question pertained to the importance of evaluating a figure by comparison to a model. Question five was about the importance of writing the proper steps in sequence. Questions six and seven were queries about the degree of importance of predicting the steps necessary in solving a problem and the degree of importance of being able to revise those steps if the steps proved faulty. All four teachers responded, "Very important", to the sixth and seventh questions.

Today's students live in an age of information that is growing and changing so quickly that no one individual can keep up with the latest version of everything. Today's students will very likely be doing more as members of teams, than as individuals, in

tomorrow's work force. Today's students will need to interact with others, share ideas, revise ideas, receive directions, and give directions to others as the team searches for a solution to the problem at hand. A feeling of self-worth and self-confidence would make a team member more capable of sharing ideas and less apt to see a team revision of those ideas as a personal affront.

On part three of the pretest (Appendix E:77) developed and administered by this author, two of the five students in the author's Computer I group were able to write legal commands in a complete series of steps; neither got all five figures correct. The other three students wrote only one or two commands. Because all five students had reproduced at least one figure correctly on the screen, this was clearly not a problem in knowing the commands for moving and turning. All five students had trouble visualizing where to go from the starting point in at least one figure. All of the students started the maze over at least once while trying to turn the turtle to its left or right and move the turtle forward or back. One of the students cried

and did not finish the maze. The same student was able to duplicate three of the five figures to the screen.

Objectives

This author set four objectives for the practicum.

1. By the end of the implementation period of 11 days, at least four of the five students in the target group will show increased awareness of directionality by maneuvering the turtle through the maze (Appendix F:79) with fewer spins in the same direction and fewer direction changes than on the pretest. This will be evidenced by a decrease in the time it takes to get the "turtle" through the maze in the second race as compared to the first race.

2. By the end of the implementation period of 11 days, each student in the target group will demonstrate the ability to formulate a plan and give the "turtle" the commands to duplicate, on the screen, at least one more of the five figures on the posttest than the student was able to produce correctly on the pretest.

3. By the end of the implementation period of 11 days, the five students in the target group will demonstrate an increase in the ability to write clear and accurate commands that enable the turtle to

duplicate specific figures. This ability will be demonstrated if the student is able to cause the "turtle" to duplicate correctly one more of the five figures on the posttest than was duplicated correctly on the pretest.

4. By the end of the implementation period, all of the students in the target group will have demonstrated proficiency in the use of EZ Logo commands by producing at least one original computer graphic.

CHAPTER II

Research and Solution Strategy

Research

Encouragement to teach thinking skills is evident in some schools and absent in others. Some school systems have purchased commercial packages specifically for this purpose. Other school systems expect the teaching of thinking skills to be incorporated into the regular curriculum. Still others expect students to become better thinkers by learning specific subjects. Quellmalz (1987:86) stated that school systems hoping to develop reasoning skills in students need "systematic programs that combine a coherent framework of skills with sound instruction and assessment." Quellmalz also claimed the design of higher order instructional tasks and assessments should include the following phases: skill-acquisition, systematic maintenance, generalization activities, and transfer activities.

Why teach thinking skills at all? Nickerson (1987:28) pointed out that human beings can think

without formal training; thinking is ". . . a consequence of being human. . . . We can no more avoid doing so than we can avoid breathing." Nickerson (1987:28) believed what educators really want to teach is "not how to think in an absolute sense, but how to think more effectively---more critically, more coherently, more creatively, more deeply..." The goal, according to Pogrow (1985), should be to develop the ability to think not just to develop thinking skills. It is important to have the ability to associate facts and create a thesis, whether it be an argument, a principle, or a hypothesis. To construct associations "requires the ability to take ideas out of their particular contexts, to reformulate them and then to construct new ways of categorizing them" (p.27).

Quellmalz (1987) believed that test scores prove most students perform poorly on higher order thinking skills and that the following contribute greatly to this deficiency:

1. "Procedural routines are seldom made explicit to students and teachers" (p. 95).

2. Reasoning skills are seldom the focus of the instruction.

3. Educators assume reasoning skills are inadvertently absorbed in the process of doing an assignment.

4. Time spent on a task is too short to allow discussions and assignments that could provide an environment for analysis.

Nickerson (1987:28) reiterated Quellmalz' third point by stating

> . . . There is little evidence that students acquire good thinking skills simply as a consequence of studying conventional course materials. Although domain-specific knowledge is essential to good thinking within a domain it is not sufficient to assure that good thinking will occur. . . . If students are to acquire good thinking skills in the classroom, explicit attention will have to be given to that objective; it is not likely to be realized spontaneously or as an incidental consequence of attempts to accomplish other goals.

Schwartz (1987:121) believed good "critical and creative thinking take place in a context of questioning and open inquiry that requires" open-mindedness and the ability to consider other points of view.

Computers may be changing learning styles if, as some people believe, this technology is affecting how and what people think (Costanzo, 1985). Many of today's schools incorporate computer assisted

instruction (CAI), computer simulations, and computer programming into the curriculum. Mathematics, language skills, science, social studies, and the arts are taught in schools because these subjects give students "a significant way to think about things, to express ideas, and to examine other people's thoughts" (Luehrmann, 1985:14). In answer to the people who question the worth of teaching computer programming, Luehrmann further stated that computer programming gives students the same training and, therefore, has a place in the curriculum.

Other educators and researchers believe Logo can foster the development of some academic gains and certain cognitive and/or metacognitive abilities. Clements and Gullo (1984) stated that Logo encourages students to concentrate on how they think and also develops the metacognitive ability to realize whether or not they understand instructions. Lough (April 1983) believed that Logo may foster an attentiveness to rules and a habit of proofreading because spelling and syntax are so important in programming. Costanzo (1985:520) claimed that while using Logo, students

> relate what's new to what's familiar, assimilating the unknown to their store of personal knowledge. Knowing they can do this, they begin to see

> themselves as active directors of their own learning. . . . They're acquiring powerful ideas about learning.

Watt (1984:9) wrote, "When you use Logo to make the computer do things, you're learning about the things you're making it do. Learning with Logo can help you understand more about yourself and the ways you learn." Maddux and Johnson (1988) stated that Logo will be recognized as a truly great educational innovation if all the proclaimed virtues are true.

Some educators and researchers are skeptical of Logo's ability to foster development of cognitive and/or metacognitive thinking skills. Research seems to indicate Logo has failed to cause students to attain higher cognitive levels at an earlier age, thus reinforcing Piaget's theory that

> the sequence through the levels is fixed and that not even favorable environmental interventions can allow young children to deal with abstract concepts before they reach the period of formal operations." (Maddux and Johnson, 1988:64)

Dalbey and Linn, as cited by Fay and Mayer (1987), found Logo learning was not generalized and what little transfer took place was probably a direct result of instructional emphasis on transfer.

Seymour Papert envisioned a computer language that would allow students to learn by interacting with the

computer (Maddux and Johnson, 1988). Logo is the computer language that is based on Papert's "object to think with" theory. In the late 1960's, Papert organized a research team at MIT. The team's interest in artificial intelligence greatly influenced the development of the new computer language. The computer language's name, Logo, was derived from the Greek word "logos" meaning thought or word (Lough, March 1983).

The language was redesigned and refined over the years. Graphics capabilities were added to appeal to younger students and to make use of the new microcomputers with more highly-developed graphics capabilities. The mechanical "turtle" that rolled across paper on the floor was replaced, in today's classrooms, by a triangular, cybernetic "turtle" on the computer screen. Of the several versions of Logo once available, most are no longer available--probably because some were system specific and those systems are no longer built. Logo Computer Systems, Inc. (LSCI) now markets the more extensive and expensive Logo Writer instead of Apple Logo.

Several single-keystroke versions of Logo were developed to make it less difficult for young students to maneuver the "turtle". Anderson borrowed the

single-keystroke idea from Instant Logo and developed Easy Logo (Swett, 1983). The 24 activities in Easy Logo include guiding the turtle through mazes; copying patterns, shapes, and letters; using penup and pendown commands; and using special shape commands that instantly produce various sizes of squares, circles, triangles, and rectangles. Now known as EZ Logo, this software is marketed by Minnesota Educational Computing Consortium (MECC) to be a preparatory step to Logo and to develop the following skills :

- recognizing left and right directions
- estimating distances and degrees
- using procedures as building blocks
- drawing shapes
- recognizing repeating patterns and designs
- recognizing symmetry
- gaining familiarity with the computer keyboard
- developing problem-solving strategies

(Minnesota Educational Computing Corporation, 1985:2).

Interpretations of research results concerning Logo vary. Schwartz (1987:111) said eyewitness testimony can be nonconsciously or deliberately influenced by "prior expectations, general beliefs, attitudes, values, and even theories and ideologies." Because Logo is relatively new to education, most of the research describing the effect of teaching Logo to students is "intuitive and anecdotal" (Maddux and

Johnson, 1988:69). Becker, cited by Bracey (1988), seemed to think many how-computers-affect-education studies are methodologically weak and biased toward favorable outcomes. Becker indicated the following weaknesses in studies:

1. Traditional learning and computer learning were not compared.

2. Groups were not compared or abilities were not measured before the study.

3. Groups were not randomly assigned.

4. Study spanned a very short time.

5. The groups were too small.

Bracey (1988:30) stated, ". . . I find more weak studies in the area of computer research . . . and I don't find the editors of computing research journals particularly astute at detecting problems." Perhaps these problems account for the difficulty in interpreting study results and the validity of the interpretation.

Clithero (1987) declared Instant Logo, a single-keystroke form of Logo, to be a pedagogically sound, powerful tool in developing problem-solving skills, math concepts, and art concepts in young students. Howell, Scott, and Diamond (1987) conducted

a project to determine if using Instant Logo had any effect on left/right discrimination, knowledge of shape names, letter recognition, and art work of five-to seven-year-old students. The formal test results showed differences that were not significant. Teacher anecdotal records conflicted with these results by showing an increase in left/right awareness, as well as positive findings in the other areas (Howell, Scott, and Diamond, 1987). Results of this study showed Instant Logo did not significantly increase the cognitive developmental growth of these students. In defense of Logo, Howell, Scott, and Diamond (1987:258) stated it is possible that single-keystroke

> software packages are not representative of the programming language Logo in that they do not allow the child to explore the mathematical and problem solving capabilities inherent in the standard version of the language.

These results could be due to the fact that the teachers' instructional vocabulary contained directional references. Aside from methods used, bias could also be a factor in the difference of results. There are many studies "whose findings seriously challenge the validity of the observation-based reports of the teachers" (Howell, Scott, and Diamond, 1987:257). Chapman, as quoted by Howell, Scott, and

Diamond (1987:257) stated, "One of the most striking findings of these studies is the persistence of illusory correlation in the face of contradictory reality." Piaget would conclude that the normal development of students in this age group could account for the nonsignificant performance differences (Howell, Scott, and Diamond, 1987).

Seymour Papert felt the carpenter, not the wood, was to blame if the house fell down. This author interpreted Papert's analogy as a reasonable request to direct more attention to the methods of the educators and researchers as the possible cause of Logo studies not achieving more positive results. Harper (1989:11) interpreted this same analogy similarly--"Papert is saying that in the hands of a good teacher who knows his or her tools, is in the right environment, and has the special skills required, Logo can amplify thinking skills."

Burns and Hagerman (1989) believed that how students view their own intelligence--as expandable or having a fixed amount--affects their approach to problem solving. Subsequently a study was conducted using Logo for four and a half months with third-grade students. Emphasis was placed on breaking complex

problems into more manageable subproblems and seeing errors as a natural part of the learning process, not indicators of failure. The control group, using Delta Draw, received similar programming experiences devoid of the task of "debugging" procedures as a result of working in a real time environment. Results showed the Logo group became less concerned about negative or positive feedback from others as they increased autonomy and intrinsic motivation.

Results of Clements and Gullo's 12-week study using Logo with six year old students showed an increase in scores on a creativity test and an increase in the ability to think about their own thinking. Another result was better identification of whether there was adequate information given to complete a task. Clements and Gullo did not get results showing an improvement in the students' overall thinking abilities of cognitive development (Bower, 1985). Papert's interpretation of the Clements and Gullo data is somewhat different. Papert felt that Clement and Gullo showed "that certain cognitive and metacognitive skills developed significantly better in a group of children who worked at Logo than in a control group who worked at CAI" (Papert, 1989:36). Perhaps this

incongruity can be explained by Bracey's (1989) statement that statistical significance is not always indicative of a study's educational value.

Using as many subjects from the original study as possible, Clements (1987) did a second study with the intent to determine if there were diffused and delayed effects on the cognitive abilities and achievement of these students. Evidence from the test results of the second study suggested Logo may have affected vocabulary and comprehension in reading and mechanics in language. Clements claimed the subjects asked more questions when they did not understand a concept indicating that they engaged more in cognitive monitoring.

In Logo, a student analyzes a complex problem, such as drawing a figure, and divides the problem into the more concrete component procedures of defining angles and line lengths. Because "Logo programming involves giving spatial commands, it should increase children's ability to describe directions from their own and others' perspectives" (Clements, 1984:1052). If students do not distinguish between left and right there will be difficulty in predicting the direction the turtle will go. An egocentric definition of left

and right or a definition in respect to the screen instead of in respect to the turtle will cause confusion. Naive conceptions of spatial reference--egocentric definitions of left/ right, forward/back and not discriminating between moving and turning--that students bring to the Logo environment can hinder the development expected to take place (Fay and Mayer, 1987).

The key idea in problem solving is looking at what is known about the situation, determining the steps necessary to obtain the desired result, and knowing the goal (Yates and Moursund, 1988-89). The kind of reasoning utilized in planning and sequencing steps to solve a problem is a higher order thinking skill (Pogrow, 1985:27). Besides planning, problem solving involves trial and error and searching for patterns (Clithero, 1987).

Solution Strategy

This author is in accord with Swett (1983) and Harper (1989) in the belief that Logo creates a non-threatening learning environment. EZ Logo was used to simulate this environment for most of the practicum implementation. EZ Logo is software that uses single-keystroke commands to allow students to create

computer graphics by moving a cybernetic "turtle", a triangular pointer, around on the screen. Students can make and correct mistakes without losing self-worth or self-confidence in problem solving abilities. The environment also provides an opportunity for creativity and encourages "attempts to master cognitive challenges" (Clements and Nastasi, 1988:100).

As supported by the research of Clements and Gullo (1984), EZ Logo helps students:

1. Develop some of the necessary critical thinking skills that enable them to give and follow directions.

2. Develop directionality relative to an object other than self.

3. Use the steps involved in problem solving by doing original graphics or specific activities.

4. Develop reflectivity by forcing students to think about and correct their errors.

5. Promote divergent thinking.

Logo's ability to stimulate creative potential was mentioned by Clithero (1987). To duplicate a figure, the student would estimate line lengths and angles, plan the necessary steps, encode the directions for the

turtle, analyze the resulting lines and angles, and revise any steps that were determined inaccurate.

EZ Logo activities 1-23 (Appendix G:81) were used to familiarize the students with moving and turning the turtle and practicing directionality. Activity 24 (Appendix H:87) was introduced to allow creative experimentation in making designs and pictures with shapes and lines. This author chose activities to encourage the use of such problem solving skills as planning, encoding, evaluating, and revising. Two Logo task cards (Appendix I:89) from a magazine were used to reinforce and encourage inductive reasoning skills.

CHAPTER III

Methods

This author used EZ Logo to provide an environment where the students could develop the thinking skills that are needed to give and follow directions. The students were introduced to EZ Logo on the second day of camp. Field trips and some all-camp events left 11 days for exposing the students to the EZ Logo/Logo environment. For the purpose of explaining the methods, day one, day two, etc., will refer to the days of implementation, not of summer camp.

Scheduling varied from day to day. One day there was only time for a 20 minute activity; another day there was almost a 2 hour block of time to use. An average of 50 minutes was spent each day on EZ Logo/Logo activities. Once they completed that day's practicum activity, the students chose between continuing their experience in EZ Logo or playing computer games. If there were questions to be answered, there were usually two to three adults to help the five students in the Apple lab.

First Week

Day one.

The target group was introduced to the EZ Logo commands. First the students were told that a program was written to allow them to tell the computer what to do. Then they heard about a "robotic" turtle that could be moved around on the floor by pressing keys on the keyboard. Five turtles moving around could become entangled and might be expensive. The students thought using the turtle's descendants that stay on the screen would be a good idea.

One student was asked to "play turtle". The author commanded the "turtle" to go "Forward". The "turtle" moved forward. Upon hearing "Back", the "turtle" stepped back. The author then told the students that life would be dull if all the turtle could do was to move forward and back. How could the turtle get off the sidewalk to knock on a friend's door? The students decided the turtle could turn.

The "turtle" was commanded to "Turn". The author then asked why the "turtle" looked so confused. The students decided that the "turtle" did not know which way to turn. The students decided "Turn Right" and

"Turn Left" would eliminate the confusion. These commands were shortened to "Right" and "Left".

Each student took a turn giving the "turtle" commands to move from Point A to Point B. Anyone who wanted to had a chance to be the "turtle". During this activity, the author monitored the "turtle's" moving and turning. This was done to be sure that the students understood "Forward" and "Back" causes the turtle to move to another place, but "Right" and "Left" only causes the turtle to face in a different direction.

Next, the students sat on the floor and watched the author demonstrate moving the turtle on the screen. After reviewing proper disk handling techniques, the author demonstrated how to boot EZ Logo I. In EZ Logo, only one key is pressed for each command. The students were asked which letter would be best for each command. As they came up with a letter, that key was pressed. After discovering that "F", "B", "R", and "L" represented "Forward", "Back", "Right", and "Left" respectively, the students were asked to determine the commands for "Clear" and "Activity".

The author then administered the pretest to the five students. After demonstrating how to get

Activity 1 on the screen, the author explained that the students were to maneuver their turtles through the maze (Activity 1). Students could start over as many times as they wanted. Once the students were satisfied with the results, they were to show the author the completed maze. Part one of the pretest consisted of getting through the maze without going through a wall.

Each student was then given a paper with five simple figures (Appendix E:77) and was asked to key in the commands to make each figure. Part three of the pretest consisted of writing these commands on paper. The students did part two and part three simultaneously. Each student worked alone. The author quietly asked each individual the question, "If I type in these commands, will I get this figure?", while indicating one set of their commands.

As each student finished the pretest, brief instructions were given to continue the EZ Logo activities in order and to proceed to the next activity when they desired but only after successful completion of the activity at hand. This allowed students to repeat any activity as many times as they wanted.

Day two.

Day two started with a demonstration of Activity 24. The 14 shape command keys were pointed out. The results of pressing these keys were seen. The students were asked to continue working through Activities 1-23 and then to experiment with the shapes in Activity 24.

Day three.

EZ Logo II was discussed briefly. EZ Logo II is the same as EZ Logo I, Activity 24. EZ Logo II has the additional feature of allowing students to save the graphic to the disk. The students stared as the turtle drew a saved procedure. All agreed that they could draw graphics and save them to the disk; then printouts could be made and put in the camp newspaper.

During the next activity, students gave oral directions to another student at the keyboard to pass on to the turtle. For this activity, only the students who were not at the keyboard were allowed to see the figures (Appendix J:92) the turtle was to draw. As a warm-up, two figures were drawn with one student at the keyboard and the four other students giving directions. After looking at the picture to be drawn, the students formed a line and took turns speaking one command and then moving to the end of the line until the figure was

drawn to the satisfaction of all. Before drawing the final three figures, the students were divided into two teams for a race. One adult sat at one keyboard, and one student sat at another. Two students stood behind each person at the keyboard and dictated directions to be keyed in to tell the turtle what to draw. The rest of the day's EZ Logo time was spent with each student at a computer experimenting with Activities 1-24.

Day four.

This day began with a discussion of how Logo was a little different from EZ Logo. Logo was booted, and the students watched one screen to discover together what the differences were. The author guided the students into discovering that the commands familiar to them required two letters, a space, and a number. The students were then allowed to try Logo or work on the EZ Logo graphics to be saved and printed later.

Week Two

Day five.

Because all five students had finished the 23 activities in EZ Logo I and were creating their own graphics in EZ Logo II, the author felt the posttest should be given at this time. The posttest was the same as the pretest. In part one, the students did

the maze (Activity 1). In parts two and three, the students made the turtle draw each of the five figures on the screen as they recorded the necessary commands. After causing the turtle to draw each figure, the student let the author see the figure produced on the screen before going on to the next figure. Once the posttest was completed, each student continued working on graphics designs to save to disk.

Day six.

Day six began with timed turtle races. As the others watched, each student had a turn at racing against the clock to see how fast the turtle could be guided through the maze (Activity 1). Afterwards the students settled down to drawing and saving pictures or designs to the disk.

Day seven.

The students finished drawing pictures. The pictures were saved to disk to be printed out later. Then the students had the choice of doing EZ Logo activities or computer games.

Day eight.

The author began the day with a demonstration of taking the turtle through a maze (Activity 1) quickly. The turtle did a lot of zigzagging and spinning around.

Then the students were asked if they thought this was a fast turtle. After discussing what was slowing down the turtle, the students did timed races to try to better their previous time. The procedure was the same as for day six of this week.

Week Three

Day nine.

On day nine, the students sat at their individual computers. The students were told to draw two squares, one inside the other and not touching. When satisfied with the outcome, the students saved the graphic to disk and cleared the screen. Next, the students did the same with two triangles. After completing the triangles, the students experimented in EZ Logo or played computer games.

Day ten.

Logo was booted into the computers. Each student had a data disk to be used with two task cards (Appendix I:89) for the day's activities in inductive reasoning. In the first activity, "Pauline's Presents", the students read clues from the data disk. If the clue eliminated one of the six names as a suspect, the student crossed that name off on the task

card. When only one suspect remained, that student's answer was checked.

The second task card, "Cubby Hole Capers", required the use of logic to match objects in lockers to their owners. In this activity, the student read the contents of each locker from the data disk and tried to match the contents to the owners whose characteristics were suggested by their names.

For the next activity, the students wrote the commands necessary to draw each of the five figures used in the pretest and posttest. The activity was done without access to a computer. On the paper and next to the figure, the students wrote the proper steps in sequence needed to produce that figure.

Day eleven.

The students were given the papers from day ten to edit. Students were to key in the commands they had written and compare the figure drawn on the screen to the one on the paper. If the students' commands were correct, the students put a check by the number of that figure. If there were errors, commands could be added, deleted, or changed altogether.

CHAPTER IV

Results

The author administered the pretest, posttest, and other tests and activities. The author also evaluated the tests and activities. The posttest was given on day five because the students had completed EZ Logo activities 1 through 23 at that time. The remaining implementation time was used for the creation and printing of original graphics, an introduction to Logo, and an extension of the skills tested on the posttest.

In this chapter, the author discusses the results of each objective. Following the discussion of the fourth objective, the reader will find a discussion of the results of the activities that took place on days nine, ten, and eleven. The author fells that this information is interesting and is necessary for a complete understanding of the project.

Objective One

Objective one was to show an increased awareness in directionality by getting the turtle through the maze in less time in the second race than the turtle had previously taken to go through the maze. The

objective was met when four of the five students decreased the race time by reducing the number of direction changes and wrong turns.

When the pretest was given, four of the five students maneuvered their turtles through the maze. Student Five tried several times, cried, and quit. The students could make as many attempts as necessary to get the turtle through the maze because the try was not timed until later when the students had become familiar with how to move the turtle. After working with the turtle in all of the activities, working on a team to direct the turtle, and discussing excessive spinning and turning, the students raced the clock on day six as they maneuvered the turtle through the maze. Two days later, on day eight, the race was done again to see if each student could achieve a decrease in race time. As Table 1 shows, four of the five students got through the maze faster in the second race against the clock.

Table 1

Individual Turtle Race Results (in seconds)

Student	Race 1	Race 2
One	74	73
Two	71	42
Three	47	59
Four	82	76
Five	265	63

Student One's turtle zigzagged twice and spun all the way around six times during the second race. This would account for such a small reduction in the race time. There were no direction changes. The spins could have been caused by pressing the key too many times or by holding the key down, thus causing the turtle to pass the turning point before stopping. The author believes Student One could not maintain turtle control at the speed attained. Student Three had a slower second race time due to three spins and two direction changes. Again, the author believes the attempt to go fast backfired and caused the turtle to

pass the turning point before the turtle could be stopped.

Student Two changed directions only once in the second race. There was a big difference in the two race times. Student Four changed directions only once but also did a little zigzagging. Both direction changing and zigzagging would have slowed down the race, but there was still a decrease in race time. Student Five cried and did not complete the maze on the pretest. Student Five's first race was filled with wrong turns, restarts, and spins. This student's performance on the second timed race showed a drastic improvement even though there were three spins.

Objective Two

Objective two stated that all five of the students should be able to improve, by at least one, the number of on-screen reproductions of the five figures on the posttest as compared to the pretest (Appendix K:94). The author instructed the students to look at the five figures on the pretest paper and duplicate these figures on the screen. On the pretest paper, the turtle was shown in the starting position. Some of the students' finished figures looked just like the paper

with the turtle in the starting position. The author did note this but did not consider it in determining if the screen figure looked like the paper figure. Four of the five students got at least one more figure correct on the posttest. Student Four got credit for drawing all five figures correctly on the pretest and on the posttest. The author judged these screen figures visually. If the angle was correct and the figure was not rotated, the figure was judged to be accurate. The four different brands of monitors in the classroom made determining the accuracy of line lengths difficult because of the inconsistency in the size of the screens. The author only had time to glance quickly at each screen because each student needed each figure checked before progressing to the next figure.

Objective Three

Objective three stated that the students would get at least one more set of the written directions correct on the posttest than had been correct on the pretest. Each student's ability to accomplish this task is presented in Table 2.

Table 2

On Paper (Objective 3) Results

		Pretest				Posttest			
Student	#	LL	A	SD	F	LL	A	SD	F
One	1	-	NA	Y	N	S	NA	Y	S
	2	-	NA	Y	N	S	NA	Y	S
	3	-	-	N	N	S	Y	Y	S
	4	-	-	N	N	S	Y	Y	S
	5	-	-	N	N	S	N	Y	N
Two	1	S	NA	Y	Y	S	NA	Y	Y
	2	Y	NA	Y	Y	L	NA	Y	Y
	3	Y	N	N	N	Y	N	N	N
	4	S	Y	N	N	S	Y	N	Y
	5	S	Y	Y	Y	S	Y	Y	Y
Three	1	-	NA	Y	N	Y	NA	Y	Y
	2	-	NA	Y	N	L	NA	Y	Y
	3	-	-	N	N	L	N	N	N
	4	L	Y	N	N	L	Y	N	Y
	5	-	-	N	N	Y	N	N	N
Four	1	S	NA	Y	Y	Y	NA	Y	Y
	2	Y	NA	N	Y	L	NA	Y	Y
	3	Y	Y	N	Y	Y	Y	N	Y
	4	L	Y	N	Y	N	Y	N	Y
	5	S	N	N	N	S	N	Y	N
Five	1	-	NA	Y	N	Y	NA	Y	Y
	2	-	NA	Y	N	N	NA	N	Y
	3	-	-	Y	N	Y	Y	Y	Y
	4	-	-	Y	N	Y	Y	Y	Y
	5	-	-	-	-	N	N	N	N

Note. # = Figure number; LL = Line length; A = Angle;
SD = Starting direction; F = Figure.
Y = Correctly done; N = Not done correctly;
NA = Not applicable; - = No answer given;
S = Short; L = Long.

Three of the five students could not write a complete set of commands on the pretest. Students Two and Four did write complete commands on the pretest. Student Two had three correct figures on the pretest attempt at writing commands and five correct figures on the posttest. Student Four wrote the commands to produce four figures correctly on both the pretest and the posttest. The angle on the fifth figure was the major problem both times. Student Four did get this angle correct later, on day ten, when doing these figures without the computer. This objective was not met when the posttest was administered. The author notes, however, that all five students did get one more figure correct by the end of the implementation period.

Objective Four

Objective four stated that the students would demonstrate proficiency in using EZ Logo commands by producing at least one original graphic. This objective was met. All five students had original drawings or designs (Appendix L:96) saved to disk. The graphics were printed and appeared on the last pages of the camp newspaper. All Computer I students also took

home a personal folder containing printouts of graphics they produced using EZ Logo, Dr. Halo, and Print Shop.

The following results of the activities of days 9, 10, and 11 are included for the reader's information. These extension activities had nothing to do with the objectives of the practicum.

Day Nine

The students were asked to draw a triangle inside a triangle and a square inside a square. This activity was monitored for following directions, erasures, spins, long way turns, and retracing. Table 3 shows the results of this activity. An erasure means a line was drawn too long or in the wrong place and either partly or entirely erased to correct the error. A spin occurs when the turtle is turned past the intended stopping point and continues in the same direction until reaching the stopping point again. A long way turn is turning the turtle in one direction to get to the stopping point when it would have been shorter to go in the other direction. For example, making a 270 degree turn to the right is a long way turn since 90 degrees to the left would have caused the turtle to

stop in the same spot. Long way turns are not wrong, just an alternate way of arriving at the same destination. Retrace means the turtle is moved along a line that has already been drawn. A direction change means the student started turning the turtle in one direction and then turned back.

Table 3

Results of Day Nine Shape-Drawing Activity

Student	Shape	FD	E	S	LWT	R	DC
One	N Tri	Y	0	0	0	0	0
	N Sq	Y	1	0	0	2	0
	Oct	Y	0	0	0	0	0
	Star	Y	0	0	0	0	0
	Hex	Y	0	0	0	0	0
Two	N Tri	N	1	0	0	0	0
	N Sq	N	1	0	0	1	0
Four	N Tri	Y	0	0	0	1	3
	N Sq	Y	0	0	0	1	0
	Hex	Y	0	0	1	0	0
Five	N Tri	Y	3	0	1	0	0
	N Sq	Y	3	2	5	0	0

Note. N Tri = Nested Triangles
N Sq = Nested Squares
FD = Followed Directions
E = Erasures
S = Spins
LWT = Long Way Turns
R = Retraced
DC = Direction Change

Student Three was absent and did not do this activity. Student One drew the triangles with no problems. Student Two did not follow directions and drew the shapes side by side. After drawing the two requested figures, some students tried drawing other shapes. Only the triangle and square were nested. The students saved the graphics on disk, and the author was able to observe every spin and turn as the turtle drew the figures again after the students were gone.

Day Ten

The task cards were used with Logo and a data disk. At first, the students seemed a little less comfortable with this lesson. Most of the students were able to identify a suspect and determine the owner of the locker with a minimum of adult help. Student Five volunteered to read aloud to the group during the activity but seemed reluctant to write answers on the paper without adult approval of the conclusions.

The next task was difficult. The five figures were familiar to the students but writing the commands without access to the computer was foreign. All five students began to write. Four students completed the task and went to another room to play computer games.

Student Five quit and cried saying the task was too hard. Motivated by the desire to play computer games, the knowledge that the task had to be completed before the games, and a little encouragement from the author, Student Five began again and finished writing the commands.

Day Eleven

The students edited the papers from day ten (Appendix M:102). Student One had one figure correct on day ten and three correct after editing. Student One always had line lengths three turtle steps long. All line lengths in the model figures are four turtle steps long. A right angle is three turns; Student One seems to have decided that three is the best number of repetitions for angle and line commands.

Student Two had two figures correct on day ten and four correct after editing. Student Two had shorter and longer lines than the models. One figure was considered incorrect because the two lines were not the same length. In writing the commands for figure four, Student Two created a mirror image and corrected the problem when editing. The other two figures had angle problems and Student Two edited correctly.

Student Three had rotation problems with the figures before editing. Before editing, one figure was correct. After editing, four figures were correct. The problem with the incorrect figure was two different line lengths. Student Three started in a different direction to cause the turtle to end in the designated starting position.

Student Four also started in a different direction to cause the turtle to end in the designated starting position in three of the figures. Four of the figures were correct before and after editing. Student Four only edited one figure. The two lines in figure five were not the same length before editing. Both line lengths were edited to be one turtle step shorter, therefore, the two lines were still unequal. The author believes the promise of playing a particular computer game with one of the adults upon completion of the task caused Student Four to hurry through the editing.

Student Five had two correct figures before editing. One figure was correctly edited by the removal of an extra turn. The other two figures were edited by adding more turns causing the turtle to spin

(turn too far) in the fifth figure. There were wrong turns in both figure four and five; instead of changing the direction of the turns in the editing, Student Five added more turns in the same direction.

Summary

The author has been using EZ Logo for several years. Doing this practicum has changed the way the author will use EZ Logo and Logo in the future. In an effort to foster thinking skills and the ability to write directions, this author will have students write commands used to create an EZ Logo graphic and have students keep a log when doing some Logo activities. Group discussions will cover methods used in arriving at solutions, and alternative solutions and methods will be discussed. Ways will be sought to encourage transfer.

Did using EZ Logo help these students develop the ability to think? The time was too short, and physical evidence was too scarce to determine this. At least the activities gave the students a chance to exercise higher order thinking skills. This author contends that mental exercise is important to the brain just as physical exercise is important to the muscles. Using

skills strengthens, reinforces, and encourages further development of the skills. If practiced in a pleasant atmosphere, positive feelings about using the skills will also encourage development.

Some of the students really seemed to enjoy using EZ Logo when creating their own graphics. For Student Five, creating a graphic seemed to be a chore at first, but on the last day Student Five asked to use EZ Logo instead of a game. This student seemed to be under a lot of pressure to achieve and showed a lack of self-confidence and a need for reassurance when asked to do tasks that would produce a tangible result. The fact that Student Five asked to use EZ Logo indicates the development of some self-confidence within the EZ Logo environment. One of the other students seemed to carelessly rush through EZ Logo tasks with the hope of playing Where in the World is Carmen Sandiego? with one of the adults.

CHAPTER V

Recommendations

Objective One

If this project were repeated, the author would make certain changes. A discussion of these changes follows. Without the students' knowledge, the first attempt at going through the maze would be timed and carefully monitored for the number of restarts, wrong turns, and spins. The information gathered would provide a base line for individual progress as well as for a comparison of students. The first turtle race also needed more careful monitoring of spins and wrong turns.

Objective Two

The author would not draw the turtle on the paper pretest figure. Indicating the starting and stopping points with a green and a red dot respectively would aid the author's visualization of the student's starting direction strategy. Visual judging of the figures would be more accurate if the monitors were all the same brand and the screens were the same size. Then the figures on the pretest paper could be drawn to scale to be the same size as the desired screen figure.

This would give a better idea of the student's visual perception abilities in relation to size. The author would also be able to more accurately determine if all lines in the figure were the same length. Monitoring one child at a time instead of all five simultaneously would also contribute to greater accuracy.

Overall Project

This practicum implementation had the same shortcomings as some of the research projects discussed in the paper. The author had little or no control of two factors. The implementation time was too short, and the group studied was too small. Teacher judgment was used to determine if certain objectives were met.

The use of the Logo task cards was an attempt to see some transfer of the thinking skills the students had been using in copying and drawing graphics. In the author's opinion, transfer requires discussion, examples, and teaching. Materials need to be developed, tested, and revised to aid in the transfer of thinking skills. Then thinking skills learned in one context could be used in situations with a related context and in situations with a different context.

The author recommends encouraging the students to keep a log when working in the Logo environment. This

should help students learn to write directions. Giving examples of other situations in which a specific skill would be used when discussing the thinking skill helps develop transfer. The author also recommends discussing the thinking steps involved in reaching solutions. Students do not all use the same strategies to reach a solution. Discussion of strategies helps students see there is more than one way to reach a solution and that a different way is not wrong.

The author will be sharing on an informal level with associates what has been learned from this practicum experience. The faculty at the author's home school will also be encouraged to look at the Logo environment as a way of developing thinking skills. The author will have several opportunities to share this paper in the next few months. The author will be coordinating a 2-hour session, on integrating computers into the elementary curriculum, that will be presented for interested teachers in the school district. The author has also applied to be one of three presenters of a Logo session at a state computer conference.

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Appendices

Appendix A

Camp Newspaper

The students wrote interview questions using MS-DOS, interviewed campers and counselors, and used Children's Writing and Publishing Center to write the articles and do the graphics. The line drawings created with EZ Logo were included on the pages marked "Computer 1 Art".

Appendix A

Camp Newspaper

Nova News

July 27, 1990
VOLUME 23

EDITORS:
Claude & Adam

ASSISTANT EDITORS:
Matt & Steven

Note from the Computer Camp Counselor

The children in both the morning and afternoon Computer Camps have worked very hard on their computer projects and on preparing this issue of the Camp Nova News. We have learned a lot together and also had lots of fun. All the computer campers have worked on both the Apple and Tandy computers. They learned to use MS-DOS to create files, learned how to create graphics with Dr Halo, and had fun with "Where in the U.S.A. is Carmen Sandiego?" We even found time to play games. The morning camp won the dress-up contest (they made thier costumes using computers as a theme). The afternoon camp did a great job on their Computer Rap. All of the children attending Camp Nova are special, but there is something extra special about our computer gang. I want to thank the Summer Graduate Interns for the great support they have given me. The computer staff and I really enjoyed working with these talented children.

Information For you

BY:Abby

If you want some advice about Universal and Typhoon Lagoon you've come to the right place. I

just came back from Orlando. So I'm full of information.

I'll start with Universal. Some of you have heard that a lot of the rides have been closed. If you're really not sure which ones, here they are: JAWS, KING KONG and EARTHQUAKE You get free pass for whenever!

The best ride was E.T but you don't have to take my word for it. Nik was a tour, it was pretty boring. The best part was that you got to audition at the end. Now for Typhoon Lagoon "THAT WAS FUN". There're all kinds of slides. There was a family ride too. Mayday is fast. There was even a creek (pool) that went around the whole park. I liked that the best. That's all !!folks!!

THE SPORTS HALL OF SHAME

BY: CLAUDE

In 1986, During a National Football League playoff, New York Giant's kicker Sean Landeta made the most shameful punt ever! Minus seven yards! Landeta tried to punt from his own goal line; but he completely missed the ball.The Chicago Bears scooped up the ball and trotted in for a touchdown

Appendix A

SPACE AND ROCKETRY

I interviewed Bruce in Space and rocketry and I asked him.....
HOW LONG HAVE YOU BEEN ATTENDING CAMP NOVA: 2 SUMMERS
WHAT CAMPS DO YOU LIKE BEST: SPACE AND ROCKETRY
WHAT CAMPS ARE YOU IN: SPACE AND ROCKETRY AND HE'S AFTERNOON ACTIVITIES COORDINATOR.
HOW CAN CAMP BE IMPROVED: MORE ACTIVITIES AND MORE SELECTION FOR THE ROCKETS
WHO IS YOUR IDOLE OR FAVORITE PERSON: RON

written by Adam

A Camper's View.

by Ilana

I interviewed Ravid . He is a student. In the morning he is in World of Fun. In the afternoon he's in sports 1. He said he likes World of Fun best. His favorite activity is cooking in World of Fun. His favorite counselor is Fredda and she is his mom!

I interviewed Kathleen , she is a math teacher. She enjoys meeting the campers that arrive and her favorite counselor is Steve. She is going to stay here for 3 weeks.

Written by: Renatta

SPACE AND ROCKETRY

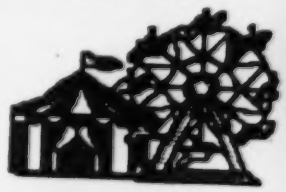
When I asked Jesse from space and rocketry what he does and if he enjoys it. He said, "We get to build rockets and then launch them". He said he likes it because it's really fun to build the rockets. When I asked Sheree how she thinks the camp could be improved, she replied by saying "I think that we should be able to build more rockets and we should have a bigger variety of snacks". When I asked them what things do they enjoy doing the most during the week, both agreed that their favorite thing is launching the rockets after they are built.

By Avi

An Interview

by Mason

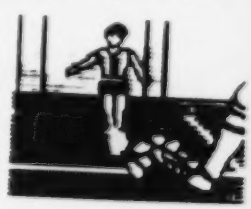
The name is: Gilbert . He has been attending Nova for two weeks. He is in computer camp. He likes computer camp the most. The activity he likes the most is sports. He thinks Camp Nova can be improved by having more field trips. He likes Camp Nova because they offer many activities.



SOCCER CAMP

By:Jason W.

I Like Soccer Camp because it's fun. Sometimes we play against other groups. Thursday we had to run a RE-Lay Race and Soccer. One time I made 2 goals.



Appendix A

TENNIS TALK

by Kevin

This is Danny's first time at Camp Nova. He's in Tennis and Drama. He likes Tennis the BEST! His favorite activity is the Video room! His favorite Counselor is Ron! His favorite food is peanut butter and jelly.

Ron has been here for 11 years. He's a Science Teacher. He likes the beach. He likes scuba diving. He teaches Lauderdale Lakes Middle School.

SOCCER!!

I interviewed Damian from soccer. He has been attending cam for two years. His favorite camp is soccer. He likes soccer games. He says that camp can be improved by having more older kids. His favorite teacher is himself. He teaches in the morning and afternoon. Damian is sometimes very funny. That's why everybody likes him. Most of the time he eats lunch with his friends. He is my best pal.

Written by: Ayesha

Soccer Camp

by Omar

In Soccer Camp we play Soccer, I like to play Soccer, I play Soccer at home too. Damian is the Soccer counselor. We play Soccer in the gym on rainy days.

Arts and crafts

I am Ayra and I interviewed Wendy. Wendy likes working with kids, she has been working with kids for 4 years. She also likes working here.

WORLD OF FUN

Ms. Katz is a counselor for World of Fun. She loves to cook. She has traveled to North America, South America, and Europe. Her favorite country is the USA. She talks French and Yiddish.

By Melissa

World of Fun

By Vara

Seth is in World of Fun. He likes swimming and diving. He likes World of Fun best.

Karate Bay

By Theo

The karate teacher name is Lee. Tournaments make Lee feel nervous but are sometimes fun. Lee spends most of his time doing karate and playing with is dog. Lee has been teaching karate for eleven years.

ADVANCED REACHING OUT

TIGERS

The theme for the second session is "The Seashore and the Sea". All the campers had a great time looking at various seashells and making seashell collages. Other activities were : barefoot painting, having their own beachparty, making rainbows, doing a "ME Mobile", sandcasting, sand sculpture, going on a treasure hunt, and having a "noise day".

The Tigers and Giraffes have a very active schedule each day including Sports and Art Option. They also go to Video Games weekly and the Movies every Wednesday morning.

The second session has been great which we ended with an "Unbirthday Party"!

COUNSELORS: Janet from UN. S.
Shannon K. from Skyway

REACHING OUT

BY: DESHA

Brenda has been in CAMP NOVA for two years. She works with REACHING OUT. Her favorite time is nap time. Can Camp Nova be improved? She doesn't know if there's something she's not happy with. We always try to be adventurous and laugh a lot.

SCIENCE

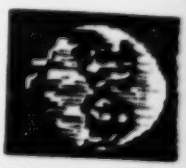
by ..latt

I interviewed Jim. He has been working at Camp Nova off and on for 12 years. Jim likes space and rocketry the best. Jim's favorite activity is swimming. Jim said the big kids should help little kids more. Jim's favorite counselor is Susan .

SCIENCE CAMP

Courtney

I went to science camp and interviewed the science teacher. His name is Jim and he is 22 years old. His favorite food is grapefruit. His favorite hobby is gardening and his favorite show is sports.



TOP 5 COUNSELORS
BY: CLAUDE A.

#1 - FREDDA
#2 - DAMIAN
#3 - MARK
#4 - DAVID
#5 - RON

SPORTS CAMP

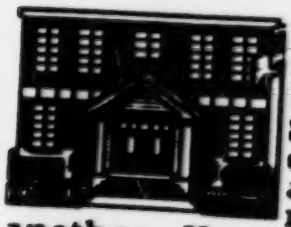
By Hamilton

I like sports camp because it's fun ; we play kick ball and other games. My teacher's name is Michael. He teaches kickball, baseball and relay race. When it rains we play in the gym.

The Director

by Tommy

The director's name is Tom He's been directing for 2 years. When



camp is over he teaches and tutors at the University School. He doesn't like any Core Camp more than another. He thinks he can improve Camp Nova by offering more Core Camps. He thinks directing the camp is a lot of work but a lot of fun. He said,"I like the kids the most last session".

AN Interview

I AM ROBERTTA AND I INTERVIEWED JASON HIS BEST FRIEND IS RON HIS BEST CAMP IS COMPUTER. HIS BEST ACTIVITY IS VIDEO. TEENAGE, MUTANT NINJA TURTLES. HE LIKES PIZZA. HE IS 14 YEARS OLD.

Tigers

By Steven

I interviewed a camper and his name is Bryan He is 6 years old. He doesn't want to come back. But he likes camp now. He's up to 4. His favorite TV show is Ninja Turtles. His favorite toy store is target His favorite state is Florida

Claudia Sanon:The Editor!!!

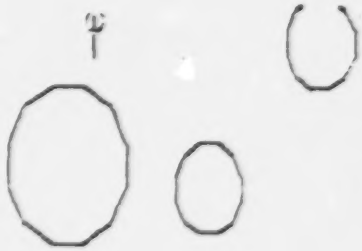
BY:KHALA

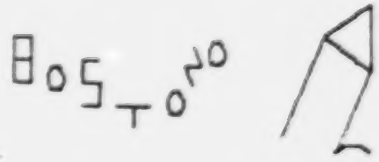
Claudia is the editor of Camp Nova. Claudia was born in France,on November 27, 1978. She is attending St.Gregory, and will be going into the 8th grade. Claudia has been at camp for 2 weeks,and takes computer in the morning and art in the afternoon. She says that she likes it so far. Claudia says that the best thing about being editor is that it's fun.

NURSE

BY:DEVON

EILEEN IS THE SCHOOL NURSE. SHE MOSTLY GETS KIDS WITH BUG BITES, STOMACH ACHE, AND SCRAPED KNEES. SHE HAS BEEN HERE FOR 2 YEARS. SHE HAS BEEN A NURSE FOR 6 YEARS. I THINK SHE IS A GOOD NURSE!





Computer 1 Art

Appendix A

COMPUTER CAMP

by Michael

I like computer camp because we play all sorts of interesting games like Dr.Halo,MACH 3,and many more.We have 7 kids in our group.We have lots of fun.And we hope you have fun too!

COMPUTER

by Aaron

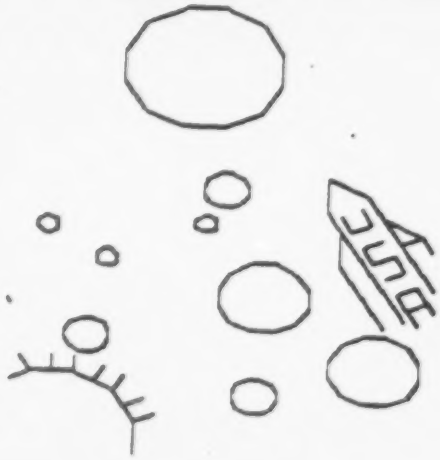
I interviewed Matt. Matt is my brother. He has been in camp for a month. Matt likes computer and science best. Matt likes chemistry best. Camp Nova can be improved by having little kids more. Matt's favorite counselor is Jim.

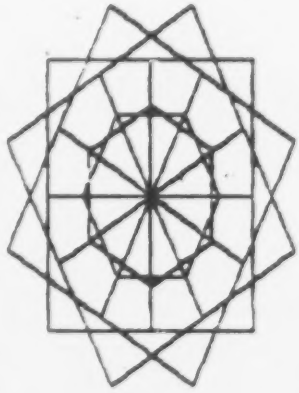
Computer Camp
by Jeff

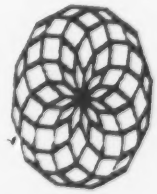
I interviewed Pat Pat is a college student helping at computer camp. She has been teaching computers for 10 years.
This is her first time at Camp Nova.
We have three other college students helping in computer camp.

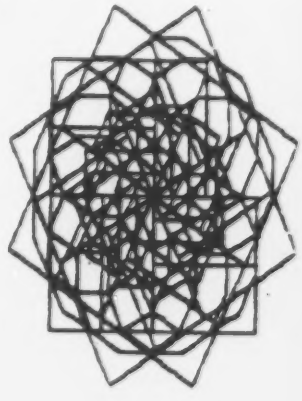
EXTRA FROM THE GIRAFFES
BY: DESHA

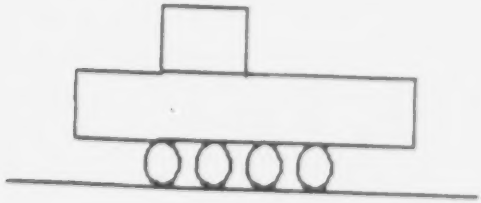
JAMIE has been at CAMP NOVA for three years. She is in ADVANCED REACHING OUT. Her favorite activity is coloring. Her suggestion for improving CAMP NOVA is to have better food.







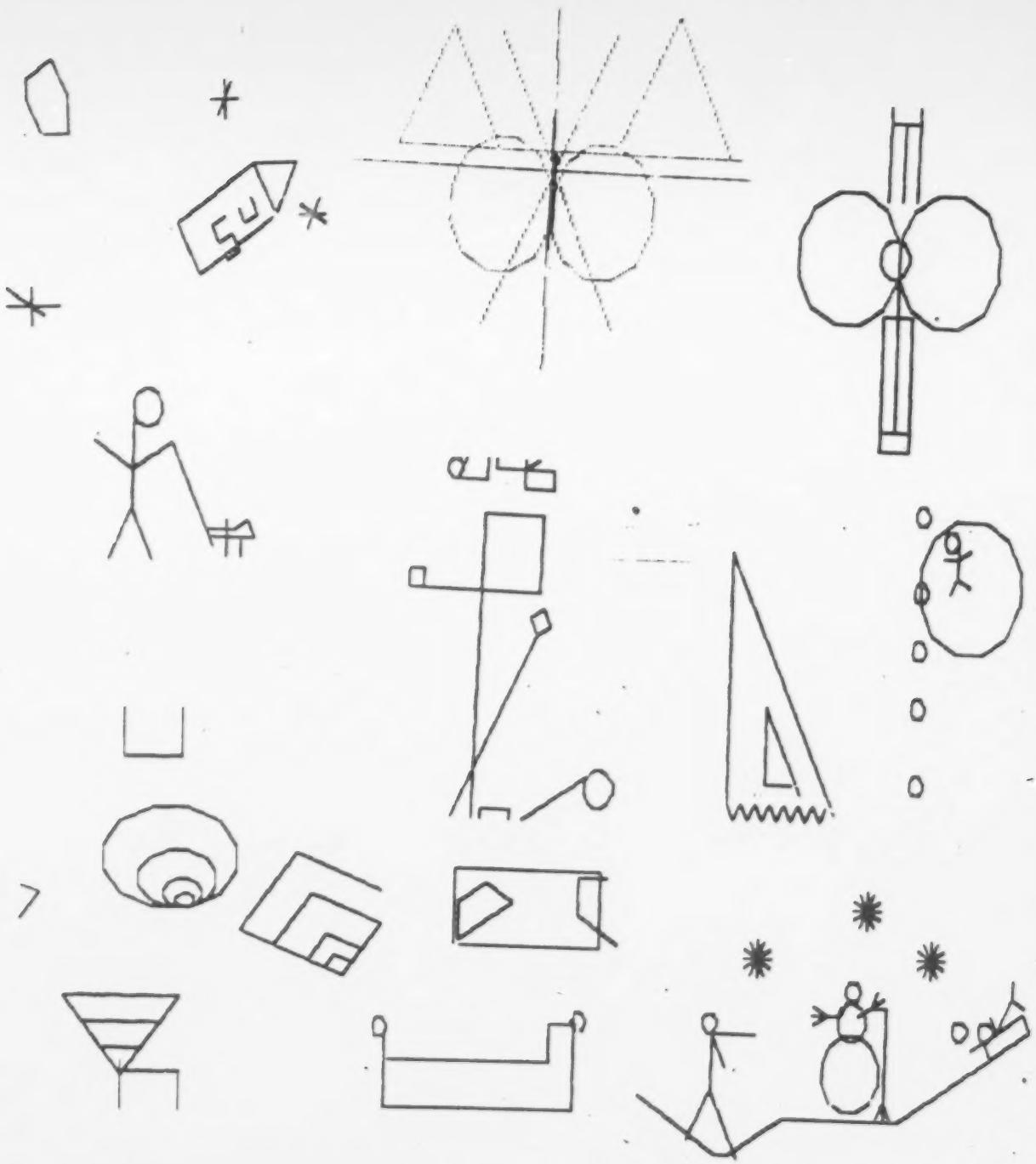




Computer 1 Art

Appendix A

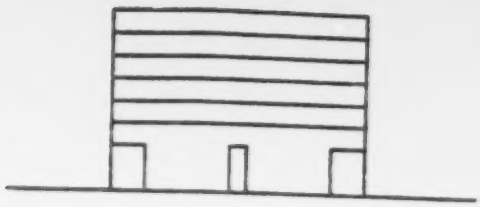
Computer 1 Art

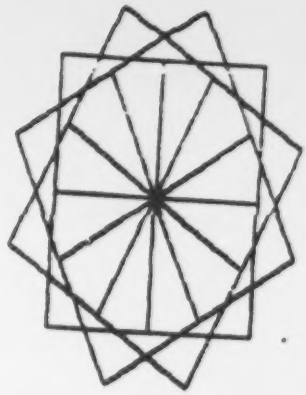


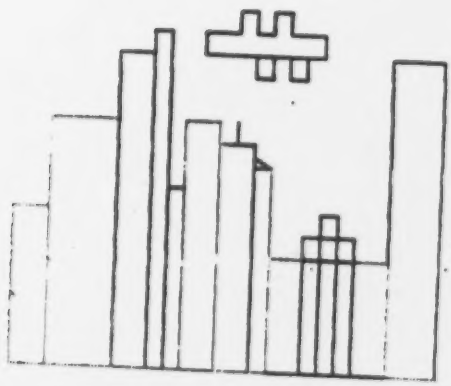
Computer 1 Art

Appendix A

Computer 1 Art







Computer 1 Art

Appendix B

Daily Log

The author kept this daily log of camp activities and practicum project activities.

Appendix B

Daily Log

Monday, July 9

9:00 - 9:45		Introduction to Computer Camp Week's schedule discussed Computer games ("Millionwaire" and "Taipan")
9:50 - 10:45		Computer I and II, computer games ("Millionwaire", "Taipan", "Where in the U.S.A. is Carmen Sandiego?", "Alligator Mix", and "Jenny's Journeys")
10:45 - 11:20		Computer II, introduction to MS-DOS
11:25 - 12:00		Computer I, booting "Scenario"
12:00 - 12:30		Lunch
12:30 - 12:50		Introduction to Computer Camp
12:50 - 1:30		Campers at Nature Option Formatted "Scenario" data disks
1:30 - 2:00		Computer II, introduction to "Scenario"
2:00 - 3:00		Computer I and II, swimming Evaluated software to be used this three-week session
3:00 - 3:30		Computer I, computer games ("Wheel of Fortune" and "Jeopardy")

Tuesday, July 10

8:45 - 9:00		Discussed EZ Logo practicum project with Computer Camp counselor/coordinator
9:00 - 9:15		Booted "Scenario"
9:20 - 9:45		Computer I, introduction to "Scenario"
9:50 - 10:35		Computer II, introduction to "Scenario"
10:40 - 12:00	*	Computer I, EZ Logo practicum project, Apple lab: introduction to EZ Logo, pretest
12:00 - 12:30		Lunch
12:30 - 1:25		Discussion of afternoon activities and practicum projects with computer coordinator

1:25 - 2:45	*	Computer I, EZ Logo practicum project, Apple lab: introduction to EZ Logo, pretest, activities
2:45 - 3:30		Computer I, computer games, Tandy lab ("Wheel of Fortune", "Marble", and "Adventures in Math")

Wednesday, July 11

9:00 - 10:35	*	Computer I, EZ Logo: taught activity 24 commands, activities
10:40 - 12:00		Discussion with practicum advisor
12:00 - 12:30		Lunch
12:30 - 1:25		Computer I, "Scenario"
1:25 - 2:10		Selected and evaluated software for use in the Apple lab
2:10 - 2:45	*	Computer I, EZ Logo: taught activity 24 commands, activities
2:45 - 3:30		Taught computer games: "Odell Lake", "Mystery Objects"

Thursday, July 12

8:30 - 10:30		Nova University Library/ERIC Search
10:40 - 12:00		Designed and made computer costumes for Friday dress up contest
12:00 - 12:30		Lunch
12:30 - 2:10	*	EZ Logo: finished activities, taught how to save a procedure, took turns giving oral directions to each other to move the "turtle" to create specific shapes
2:10 - 2:45		Discussed "Where in the World Is Carmen Sandiego?" with another graduate intern
2:45 - 3:30		Monitored pretest and introduction to "Where in the World Is Carmen Sandiego?" given by another graduate intern
		Computer I, computer games ("Odell Lake", "Mystery Objects", "Bake and Taste", "Speedway Math", "Where in Time Is Carmen Sandiego?")

Friday, July 13

9:00 - 10:00		Newspaper was discussed Computer I, wrote interview questions using MS-DOS
10:00 - 10:40		Computer II, wrote interview questions using MS-DOS
10:40 - 12:00		Finished interview questions
	*	EZ Logo graphics
12:00 - 12:30		Lunch
12:30 - 1:00		Costume contest
1:00 - 1:25		Talked about newspaper Wrote interview questions using MS-DOS
1:25 - 2:45	*	EZ Logo, introduced Logo
2:45 - 3:30		Monitored two other graduate interns' practicum projects

Monday, July 16

9:00 - 9:45	*	EZ Logo, posttest, work on Ez Logo graphics
9:50 - 10:35		Print interview questions written by Computer I on Friday
10:40 - 11:20		Phone library, discuss practicum
11:25 - 12:00		Take Computer I campers around to do their interviewing
12:00 - 12:30		Lunch
12:30 - 1:15		Print interview questions written by Computer I on Friday
1:20 - 1:50		Take Computer I campers around to do their interviewing
1:50 - 2:10	*	EZ Logo, posttest
2:10 - 2:30		Ice cream, Monday sundae
2:30 - 3:00	*	Finish posttest, work on EZ Logo pictures
3:00 - 3:30		Help Computer I write paragraph (on paper) from interview

Tuesday, July 17

9:00 - 9:45	*	EZ Logo, timed turtle race (activity 1), continued drawing and saving pictures, printed some pictures

9:50 - 10:35		Worked on EZ Logo pictures Wrote newspaper articles on paper Began typing newspaper articles with "Children's Writing and Publishing Center"
10:35 - 10:55		Ice cream treat--reward for winning costume contest last Friday
10:55 - 12:00		Continued activities interrupted by ice cream
12:00 - 12:30		Lunch
12:30 - 1:25		Print EZ Logo graphics
1:25 - 2:10	*	EZ Logo, timed turtle race (activity 1), continued drawing and saving pictures
2:10 - 3:30		Finished writing and typing newspaper articles/interviews into "Children's Writing and Publishing Center"

Wednesday, July 18

9:00 - 9:45	*	Finish EZ Logo pictures A student did a makeup race Began using Print Shop to make signs to put in graphics booklets
9:50 - 10:15		Helped a camper finish his newspaper article
10:20 - 11:30		Computer game ("Where in the U.S.A. Is Carmen Sandiego?")
11:30 - 12:30		Discuss practicum project with practicum advisor
12:30 - 12:50		Lunch
12:50 - 2:50		Worked on newspaper
	*	Continued pictures and EZ Logo activities Computer games in apple lab
2:50 - 3:30		Monitored other practicum interns' projects

Thursday, July 19

9:00 - 9:45		Printed EZ Logo graphics
9:50 - 10:35		Computer II, played "Where in the World Is Carmen Sandiego?"
10:40 - 11:20		Helped two campers finish writing and typing their newspaper articles

11:25 - 12:00		Computer II, "Where in the World Is Carmen Sandiego?"
12:00 - 12:30		Lunch
12:30 - 1:00		Practice rap and discuss rap contest
1:00 - 2:15		Traced and cut turtle props for rap contest Computer games Computer I used "Print Shop" to make covers for graphics booklets
2:15 - 3:30		Computer II used "Print Shop", traced and cut to make badge props for rap contest Helped a camper with some BASIC

Friday, July 20

9:00 - 12:30		Professional library Lunch
12:30 - 1:00		Rehearse for rap contest
1:00 - 1:30		Rap contest
1:30 - 2:20	*	EZ Logo, discussed direction of turning, turning all the way around and zigzaging Individual race for better time EZ Logo activities Computer games ("EZ Logo", "Bake and Taste", "Odell Lake", "Where in the U.S.A. Is Carmen Sandiego?")
2:20 - 3:30		Computer II, "Where in the U.S.A. Is Carmen Sandiego?" BASIC

Monday, July 23

9:00 - 9:45		Computer I, finished "Print Shop" signs Worked on EZ Logo pictures Printed EZ Logo pictures
9:50 - 10:35		Computer II, "Where in the World Is Carmen Sandiego?"
10:40 - 11:20		Printed EZ Logo pictures
11:25 - 12:00		Computer I, "Print Shop" signs
12:00 - 12:30		Lunch
12:30 - 1:25		Printed EZ Logo pictures

1:25 - 2:10	*	Draw square in square and triangle in triangle, save to disk Explore in EZ Logo
2:10 - 3:30		Computer II, "Where in the U.S.A Is Carmen Sandiego?" BASIC Helped repair a printer

Tuesday, July 24

9:00 - 11:00		Research
11:30 - 1:30		Print EZ Logo pictures Xerox papers for today's class
1:30 - 2:10	*	Logo, Clues activity induction/deduction Experiment with Logo (commands, color) --Student Five cried
2:10 - 2:50	*	Write directions for turtle without computer(posttest) -- Student Five cried; did finish after others were gone
2:40 - 3:30		Put graphics folders together

Wednesday, July 25

9:00 - 9:45		Computer I, taught "Friendly Computer" (Keyboard and Zebug)
9:50 - 10:35		Computer II, "Where in the World Is Carmen Sandiego?"
10:40 - 11:20		Wrote names on computer camp certificates Helped put graphics booklets together
11:25 - 12:00		Computer I, "Dr. Halo"
12:00 - 12:30		Lunch
12:30 - 1:25	*	Let Computer I edit yesterday's test response Played "Friendly Computer"
1:25 - 2:10	*	Experiment with Logo
2:10 - 3:10		Finished "Print Shop" booklet covers with Computer II
2:45 - 3:30		Computer games

Thursday, July 26

9:00 - 9:45		Assembled graphics booklets
9:50 - 10:35		Computer II, "Where in the World Is Carmen Sandiego?"
10:40 - 11:20	*	Experiment with Logo
11:25 - 12:00		Computer I, "Dr. Halo"
12:00 - 12:30		Lunch
12:30 - 2:10		Experiment with Logo or EZ Logo
2:10 - 3:30		Handed out graphics booklets Computer games

Friday, July 27 Research

Appendix C

Computer Camp Rap

This rap was written by the author for the Computer Camp Students to perform in a camp rap contest.

Appendix C

COMPUTER RAP

Computer camp is the name of the game,
Without it Camp Summer just ain't the same.

Startin' as gumshoe on the elevator
We're workin' our way to investigator.
We been chasin' Carmen through the U.S.A.,
Trackin' her gang both night and day.
Got a warrant for her arrest;
We followed her from east to west.

Computer camp is the name of the game,
Without it Camp Summer just ain't the same.

We used MS-DOS to write an interview;
Gettin' ready to print a newspaper for you.
Directions straight from our editors--
"Go talk to campers and counselors."

Computer camp is the name of the game,
Without it Camp Summer just ain't the same.

Drawing graphics on Dr. Halo,
And choosing fonts on Scenario,
Racing our turtles through a maze--
This is the way we spend our days.

Computer camp is the name of the game,
Without it Camp Summer just ain't the same.

Appendix D

Survey

This survey was written by the author and given to four first grade teachers.

Appendix D

SURVEY

1. Do you feel it is important for your first grade students to learn the directions "left" and "right"?

YES NO

2. Do you feel it is important for your first grade students to learn the directions "forward" and "back"?

YES NO

3. Do you feel it is important for your first grade students to develop their eye-hand coordination to the extent that they can duplicate a figure they are shown?

YES NO

4. Do you feel it is important for your first grade students to use their visual perception skills to determine if the figure they have drawn is the same as the visual model before them?

YES NO

5. Do you feel it is important for your first grade students to develop skills that enable them to record a set of properly sequenced steps when solving certain types of problems?

YES NO

6. How important do you think it is for your first grade students to develop skills that enable them to predict the directions needed to duplicate the figure shown?

VERY IMPORTANT IMPORTANT NOT IMPORTANT

7. How important do you think it is for your first grade students to develop skills that enable them to revise their steps when their predictions prove faulty?

VERY IMPORTANT IMPORTANT NOT IMPORTANT

Appendix E

Pre/Posttest: Parts Two and Three

In part two of the pre/posttest, the students typed commands to make the turtle immediately draw these figures on the monitor screen. In part three of the pre/posttest, the students wrote, on paper, the commands that, when typed on the keyboard, would make the turtle draw these figures.

Appendix E

Pre/Posttest: Parts Two and Three

Name _____

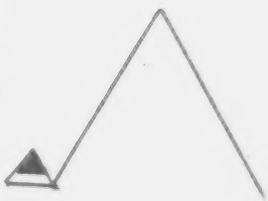
Pretest/Posttest

1.

2.

3.

4.

5. 

Appendix F

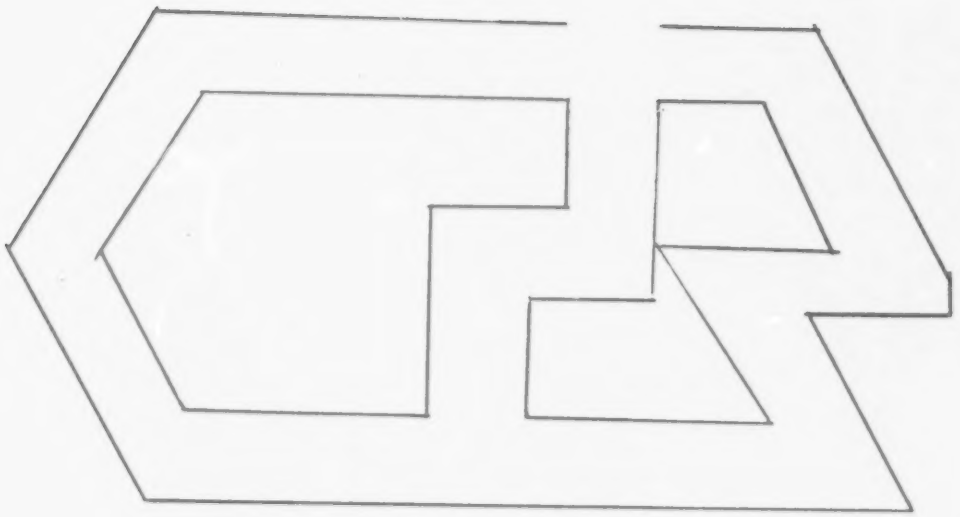
Pre/Posttest: Part One

EZ Logo Activity 1 was used as the maze in part one of the pre/posttest.

Appendix F

Pre/Posttest: Part One

EZ Logo Activity 1



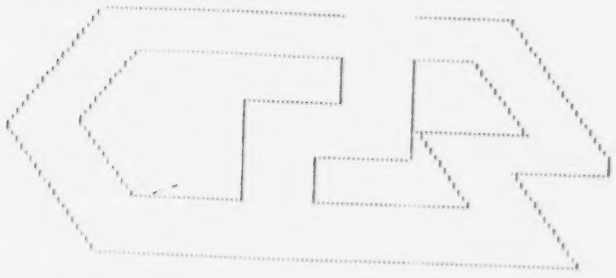
Appendix G

EZ Logo Activities 1-23

EZ Logo Activity 1 was used as the maze in part one of the pre/posttest. Activities 2-23 were used to increase awareness of directionality.

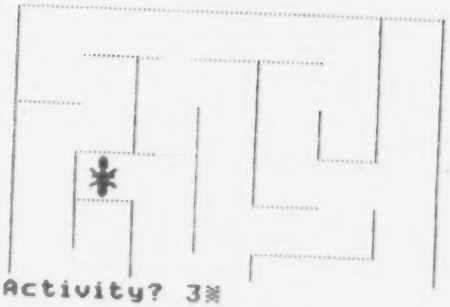
Appendix G

EZ Logo Activities 1-23
(Activities 1-4)



Activity? 1

Activity? 2



Activity? 3

Activity? 4

Appendix G

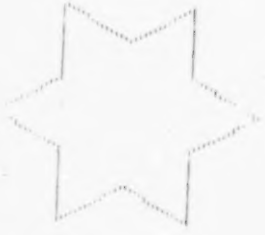
EZ Logo Activities 1-23
(Activities 5-9)

Activity? 5

Activity? 6

Activity? 7

Activity? 8



Activity? 9

Appendix G

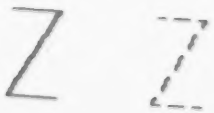
EZ Logo Activities 1-23
(Activities 10-16)

Activity? 10

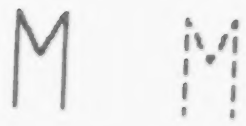
Activity? 12

Activity? 13

Activity? 14



Activity? 15

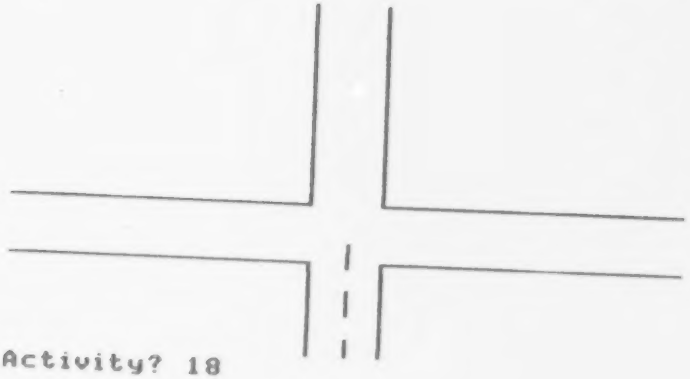


Activity? 16

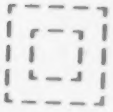
Appendix G

EZ Logo Activities 1-23
(Activities 17-19)

Activity? 17



Activity? 18



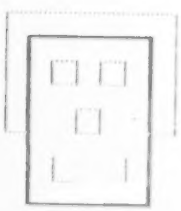
Activity? 19

Appendix G

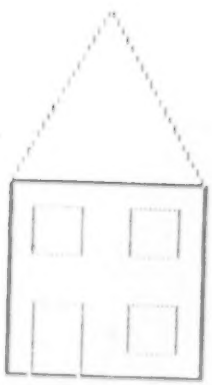
EZ Logo Activities 1-23
(Activities 20-23)

Activity? 20

Activity? 21



Activity? 22



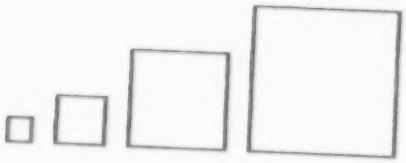
Appendix H

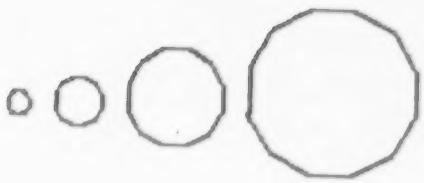
EZ Logo Activity 24
EZ Logo II

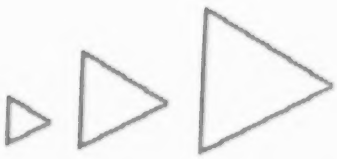
In EZ Logo Activity 24, the students experimented and practiced drawing. In EZ Logo II, the students drew, saved, and printed designs. The shapes in this appendix can be drawn with a single keystroke when in EZ Logo Activity 24 or EZ Logo II. These shapes can be incorporated in original drawings and designs.

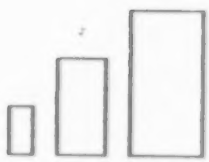
Appendix H

EZ Logo Activity 24
EZ Logo II





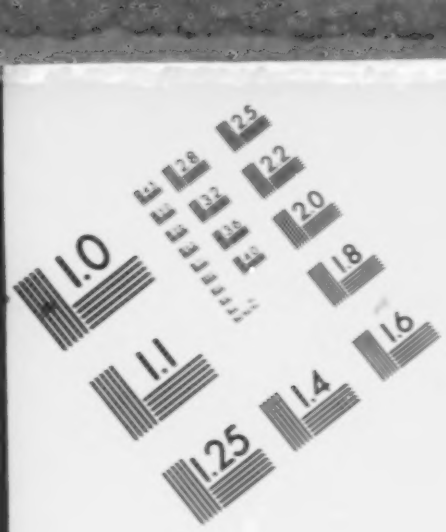




Appendix I

Logo Task Cards

These logic task cards (Boudrot, 1988:17, 18) were used for an extension activity.



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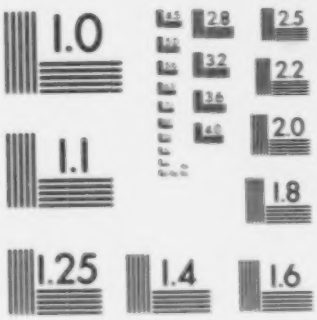
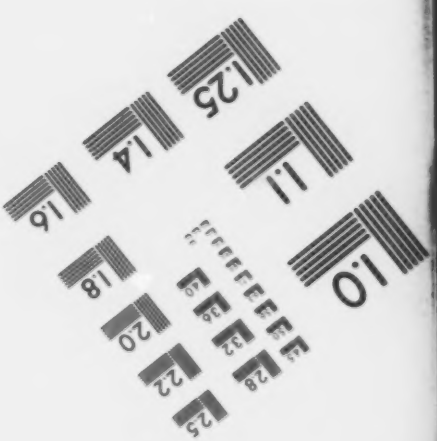
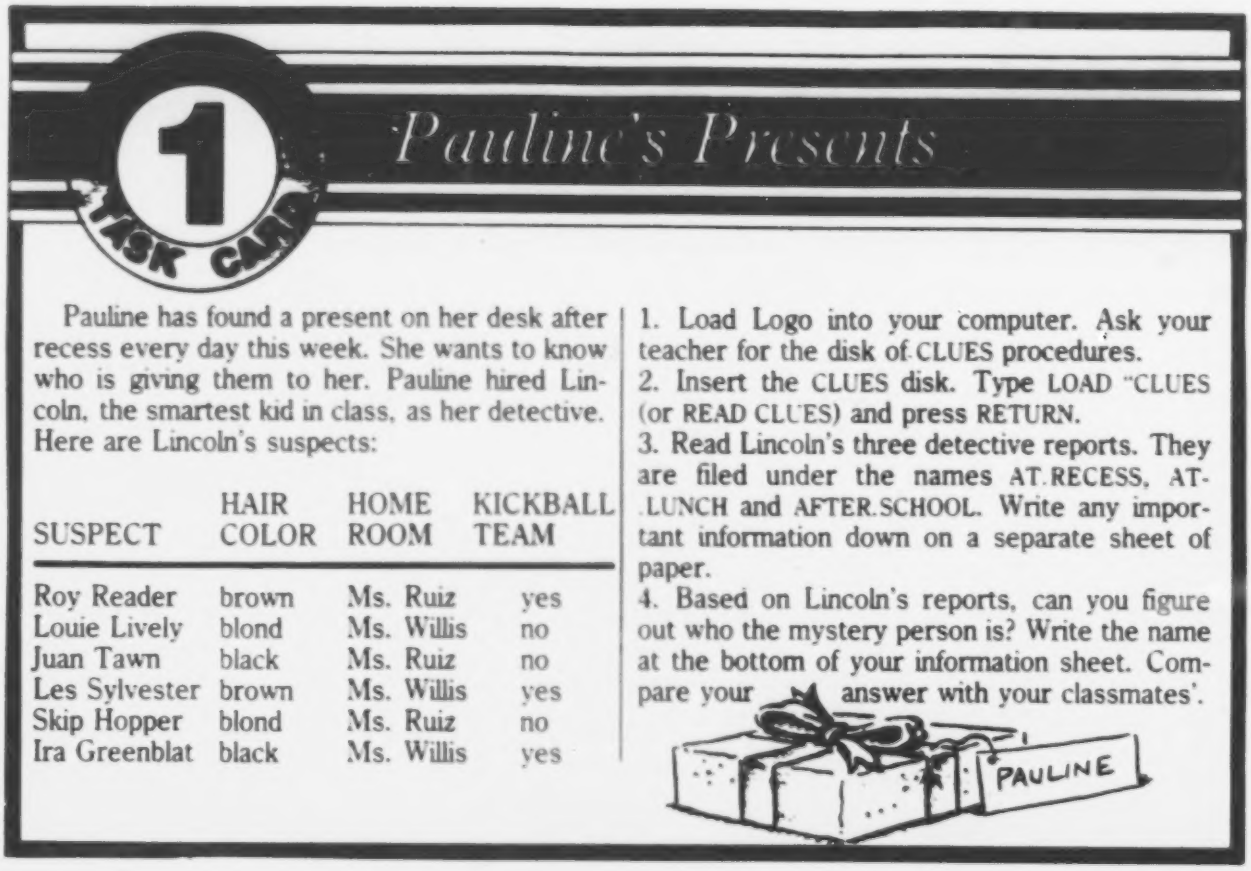




MANUFACTURED TO AIIM STANDARDS
BY APPLIED IMAGE, INC.

Appendix I

Logo Task Cards



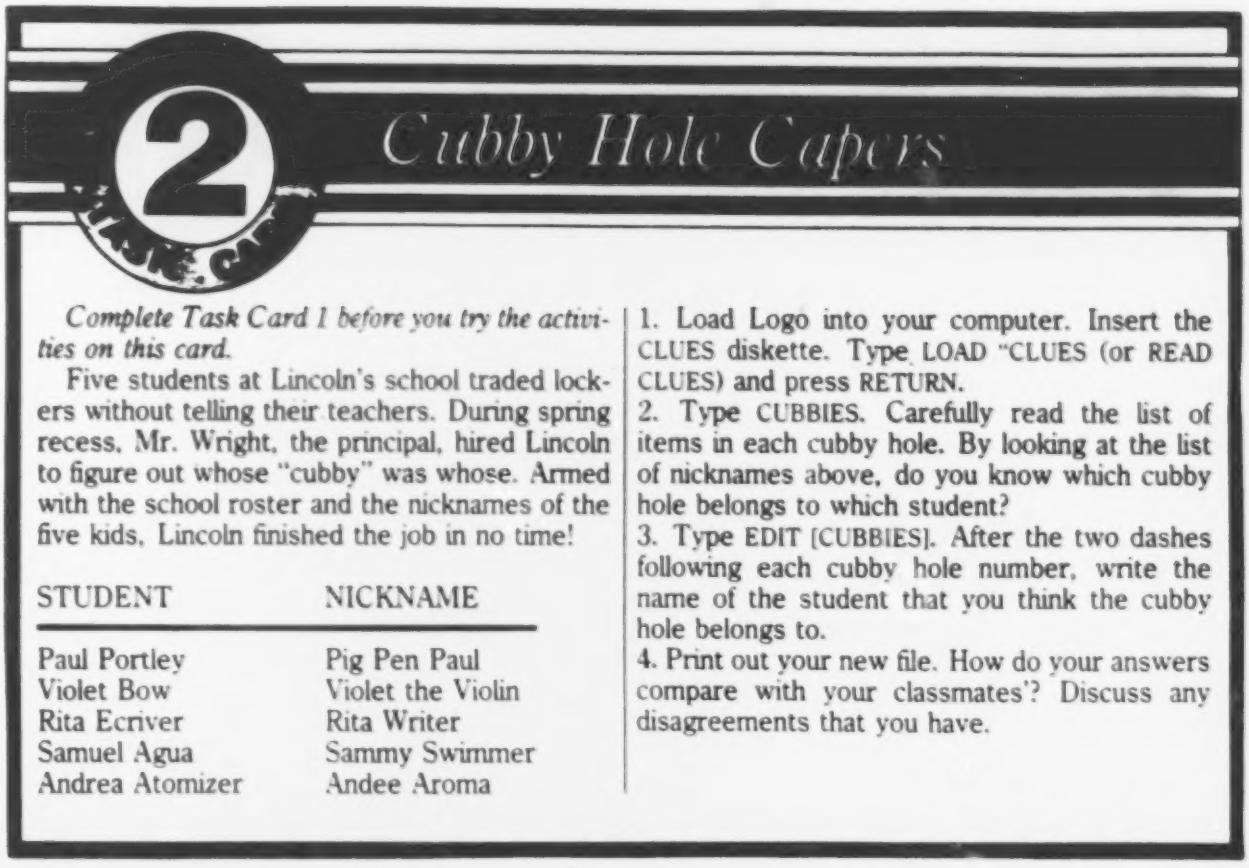
Pauline has found a present on her desk after recess every day this week. She wants to know who is giving them to her. Pauline hired Lincoln, the smartest kid in class, as her detective. Here are Lincoln's suspects:

SUSPECT	HAIR COLOR	HOME ROOM	KICKBALL TEAM
Roy Reader	brown	Ms. Ruiz	yes
Louie Lively	blond	Ms. Willis	no
Juan Tawn	black	Ms. Ruiz	no
Les Sylvester	brown	Ms. Willis	yes
Skip Hopper	blond	Ms. Ruiz	no
Ira Greenblat	black	Ms. Willis	yes

1. Load Logo into your computer. Ask your teacher for the disk of CLUES procedures.
2. Insert the CLUES disk. Type LOAD "CLUES (or READ CLUES) and press RETURN.
3. Read Lincoln's three detective reports. They are filed under the names AT.RECESS, AT.LUNCH and AFTER.SCHOOL. Write any important information down on a separate sheet of paper.
4. Based on Lincoln's reports, can you figure out who the mystery person is? Write the name at the bottom of your information sheet. Compare your answer with your classmates'.

Appendix I

Logo Task Cards



Complete Task Card 1 before you try the activities on this card.

Five students at Lincoln's school traded lockers without telling their teachers. During spring recess, Mr. Wright, the principal, hired Lincoln to figure out whose "cubby" was whose. Armed with the school roster and the nicknames of the five kids, Lincoln finished the job in no time!

STUDENT	NICKNAME
Paul Portley	Pig Pen Paul
Violet Bow	Violet the Violin
Rita Ecriver	Rita Writer
Samuel Agua	Sammy Swimmer
Andrea Atomizer	Andee Aroma

1. Load Logo into your computer. Insert the CLUES diskette. Type LOAD "CLUES (or READ CLUES) and press RETURN.
2. Type CUBBIES. Carefully read the list of items in each cubby hole. By looking at the list of nicknames above, do you know which cubby hole belongs to which student?
3. Type EDIT [CUBBIES]. After the two dashes following each cubby hole number, write the name of the student that you think the cubby hole belongs to.
4. Print out your new file. How do your answers compare with your classmates'? Discuss any disagreements that you have.

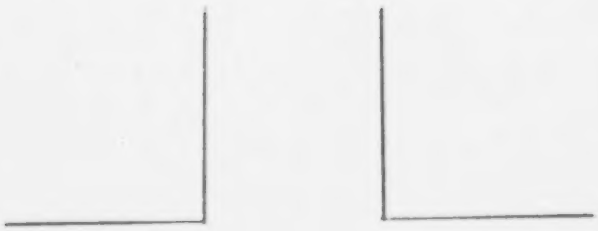
Appendix J

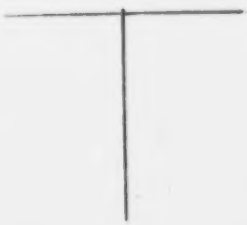
Five Figures

These five figures were used in an extension activity to practice giving directions.

Appendix J

Five Figures





Appendix K

On Screen (Objective 2) Results

This table shows the pre/posttest results of the second objective of the practicum.

Appendix K

On Screen (Objective 2) Results

		Pretest				Posttest			
Student	#	LL	A	SD	F	LL	A	SD	F
One	1	Y	NA	Y	Y	Y	NA	Y	Y
	2	Y	NA	Y	Y	Y	NA	Y	Y
	3	Y	N	N	N	Y	Y	Y	Y
	4	Y	Y	N	N	Y	Y	Y	Y
	5	Y	Y	N	N	Y	Y	Y	Y
Two	1	S	NA	Y	Y	S	NA	Y	Y
	2	Y	NA	Y	Y	L	NA	Y	Y
	3	Y	Y	N	Y	Y	Y	N	Y
	4	N	Y	N	N	Y	Y	N	Y
	5	Y	Y	Y	Y	Y	Y	Y	Y
Three	1	Y	NA	Y	Y	Y	NA	Y	Y
	2	Y	NA	Y	Y	Y	NA	Y	Y
	3	Y	Y	N	N	Y	N	N	N
	4	L	Y	N	N	Y	Y	N	Y
	5	Y	Y	Y	Y	Y	Y	Y	Y
Four	1	N	NA	N	Y	Y	NA	Y	Y
	2	Y	NA	N	Y	L	NA	Y	Y
	3	Y	Y	N	Y	Y	Y	N	Y
	4	N	Y	N	Y	Y	Y	Y	Y
	5	Y	Y	Y	Y	Y	Y	Y	Y
Five	1	Y	NA	Y	Y	Y	NA	Y	Y
	2	Y	NA	Y	Y	L	NA	N	Y
	3	Y	N	Y	N	Y	Y	Y	Y
	4	Y	Y	Y	Y	Y	Y	Y	Y
	5	Y	N	N	N	Y	N	N	N

Note. # = Figure number; LL = Line length; A = Angle; SD = Starting direction; F = Figure; Y = Correctly done; N = Not done correctly; NA = Not applicable.

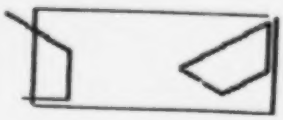
Appendix L

Student Drawings

These original drawings were created using EZ Logo II.

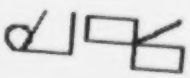
Appendix L

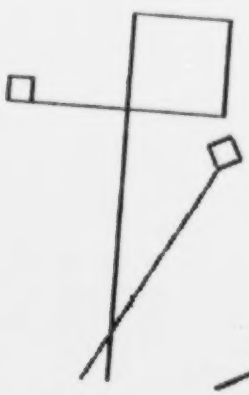
Student Drawings
(Student One)



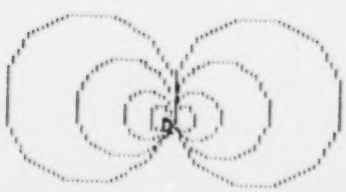
Bed

Space





Kites

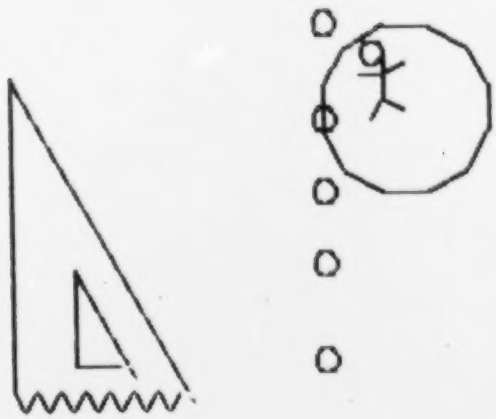


Eyes

Appendix L

Student Drawings
(Student Two)

Walk the Dog

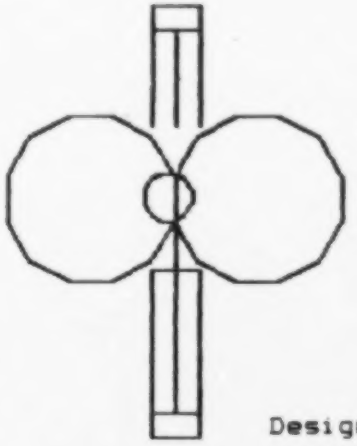


Astronaut

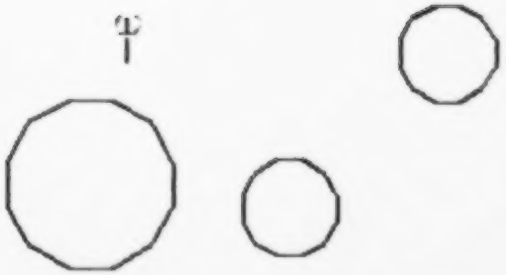
Appendix L

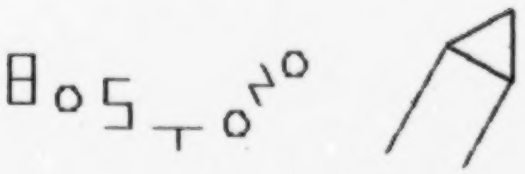
Student Drawings
(Student Three)

Boston



Design

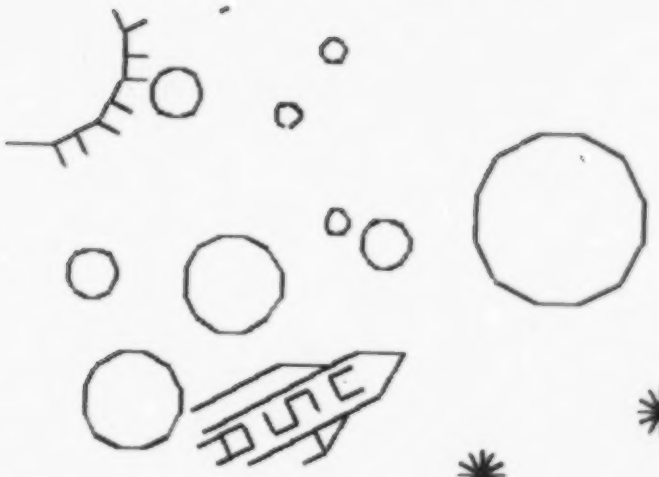




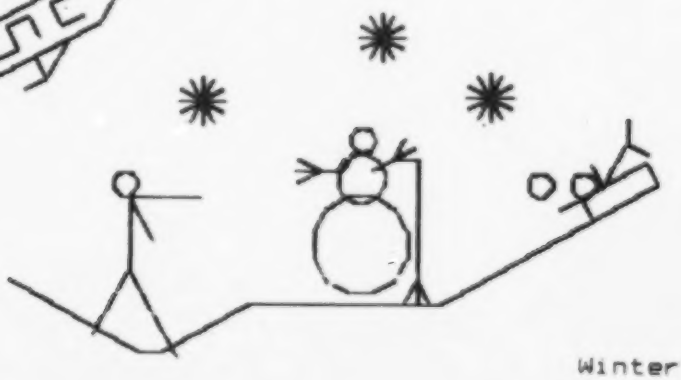
Space

Appendix L

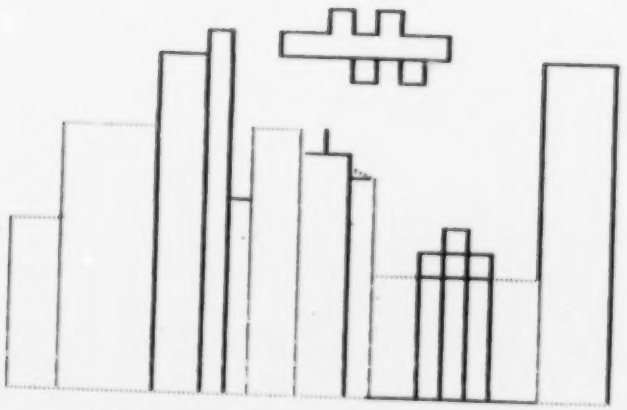
Student Drawings
(Student Four)



Space



Winter

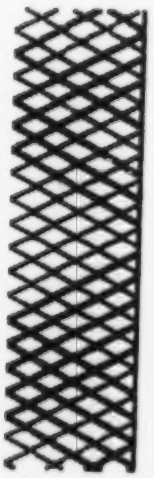


D. C.

Appendix L

Student Drawings
(Student Five)

House



Gate

Appendix M

Editing Activity Results

This table shows the results of the extension activity done on days ten and eleven.

Appendix M

Without Computer/Editing Activity Results

		Without Computer				Edited			
Student	#	LL	A	SD	F	LL	A	SD	F
One	1	S	NA	Y	Y	S	NA	Y	Y
	2	S	NA	Y	N	Y	NA	Y	Y
	3	S	N	N	N	S	Y	N	N
	4	S	N	N	N	S	Y	Y	S
	5	S	N	Y	N	S	N	Y	N
Two	1	S	NA	Y	Y	S	NA	Y	Y
	2	L	NA	Y	Y	L	NA	Y	Y
	3	Y	N	N	N	Y	Y	N	Y
	4	N	Y	N	N	N	Y	N	N
	5	Y	Y	Y	Y	Y	Y	Y	Y
Three	1	Y	NA	Y	Y	Y	NA	Y	Y
	2	Y	NA	Y	N	Y	NA	Y	Y
	3	S	N	N	N	Y	Y	N	Y
	4	S	Y	N	N	S	Y	N	Y
	5	N	N	Y	N	Y	Y	Y	Y
Four	1	Y	NA	Y	Y	Y	NA	Y	Y
	2	L	NA	N	Y	L	NA	N	Y
	3	Y	Y	N	Y	Y	Y	N	Y
	4	N	Y	N	Y	N	Y	N	Y
	5	N	Y	Y	N	N	Y	Y	N
Five	1	Y	NA	Y	Y	Y	NA	Y	Y
	2	Y	NA	Y	Y	Y	NA	Y	Y
	3	-	N	Y	N	Y	Y	Y	Y
	4	N	N	N	N	N	Y	N	N
	5	Y	N	Y	N	Y	N	Y	N

Note. # = Figure number; LL = Line length;
A = Angle; SD = Starting direction;
F = Figure; NA = Not applicable;
Y = Correctly done; N = Not done correctly;
S = Short; L = Long.

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